Box 27 Folder 6 circa 1958-1960

ORIGIN AND SPREAD OF SOME DOMESTICATED PLANTS AS SEEN FROM PREHISTORIC TAMAULIPAS, MEXICO

Since it may be sometime before a final report on the archaeology of southwest Tamaulipas can be published, it was felt that it was worthwhile to present a preliminary article describing some of the prehistoric agricultural (plant) remains uncovered there as well as in the Sierra de Tamaulipas. Generally it seemed worthwhile from the standpoint that this data may have some bearing upon the solution of the problem of the development of agriculture and concomittant rise of civilizations. Specifically it was felt that these materials plus comparisons with other areas would throw light on the problem of when, where and how a number of plants became domesticated and spread in the New World. Further, it illustrated what cultural stage and developments (at least, in Tamaulipas) could be correlated with various changes in subsistence.

The area in which these plant remains were recovered was the southern part of the state of Tamaulipas, the northeastern most state of Mexico. Culturally our area is the northeastern periphery of Meso-America.(1)

Much of the area is semi-desert as to vegetation and rainfall, though fingers of tropical climate extend into it from the south. In terms of topography, east along the Gulf of Mexico it is

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1. MacNeish, 1958.

flat, then these coastal flats give way to the hills and canyon-cut mountains of the Sierra de Tamaulipas. Further west are lower hills and the Guajeleyo valley which border the edge of the still steeper Sierra Madre of southwestern Tamaulipas.

The season of 1945-46 was confined mainly to archaeological reconnaissance in the northern two-thirds of Tamaulipas.[2] Five stratitests revealing stratigraphy were dug at that time in ruins in the Sierra de Tamaulipas. One ruin, Tm r 86, on Cerro Guadelupe contained four occupation levels of the Laguna phase (then called Pueblito I) under a definate floor of the Eslabones phase (then called Pueblito II). The other was at the La Salta ruin (Tm r 79) which had La Salta remains (then called Pueblito III) on the floor of a house platform over fill contain Eslabones sherds. In 1948-49, through some survey was undertaken along the Gulf coast and sites were excavated in the Tampico-Panuco regions, most of our activities were in the Sierra de Tamaulipas.[3] Three stratified caves were excavated. The first Diablo Cave (Tm c 81) contained a definite layer with Los Angeles remains (over) an ill-defined level with ~~over~~ Eslabones Phase materials which were on top of Nogales artifacts in a poorly define strata. These were separated by a sterile silts from a pure component with Lerma remains that in turn were over Diablo artifacts in high terrace gravels. Charcoal from a Lerma roasting pit yielded a Carbon 14 date of 7314 B.C. ± 500 years ago.[4] A second cave Nogales (Tm c 82) seemed to have in poorly define strata Los Angeles remains over Eslabones over Almagre over La Perra over Nogales. A third cave La Perra (Tm c 174) contained Los Angeles

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2. MacNeish, 1958.
3. MacNeish, 1950.
4. H.R. Crane and J.B. Griffin, 1958, pg. 1103-1104, M499

sherds and charcoal on the surface dated by Carbon 14 No. 1292 A.D. ± 150 years ago.[5] Underneath these was a mixed layer with Laguna artifacts with a large amount of preserved food stuffs and feces. These in turn were over definite floors containing La Perra remains which had even more preserved vegetal refuse. The top part of this occupation was dated by Carbon 14 as beeing 2492 B.C. ± 280 years old.[6] Underneath these remains was a sterile dust deposit over two definite Lerma occupations.

In 1955 more archaeological reconnaissance was undertaken in the Sierra de Tamaulipas and two sites were excavated. Humada Cave (Tm c 315) yielded strata with Almagre remains over a layer with La Perra artifacts while Armadillo Cave (Tm c 314) had three floors of charcoal and perishable human remains of the Los Angeles culture over poorly defined patches containing La Salta tools. These in turn were over a thicker stratum with a thin layer of Almagre artifacts over a thick section with Nogales remains. Thus from the Sierra de Tamaulipas a sequence of nine cultural phases was obtained. Of relevance to this paper were the preserved foods stuffs in La Perra (5,000 to 4,200 years old) as well as those from Laguna (2,000 to 2,500 years) and Los Angeles (from 180 to 600 years).

These materials and their implications concerning plant domestication were the basic reasons survey and excavation were undertaken in southwest Tamaulipas in 1953-55. Though we tested a few open sites and ruins we confined most of our activities to obtaining

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5. Libby, 1952, C 201
6. Libby, 1950, C 687

long stratigraphic sequence of cultures with preserved food remains in three stratified caves. In this we were extremely fortunate. In Romero Cave (Tm c 274) sixteen sequential occupations with food remains occurred over a few artifacts of the Infiernillo Phase in the underlying gravels. Occupation 1 through 4 were of the Ocampo Phase (Occupation 1 being dated as 3244 B.C. ± 350 and occupation 4 being dated 2604 B.C. ± 350).[7] Occupation 5 through 8 were Guerra remains (occupation 6 being dated as 2700 ± 300)[8] while 9 and 10 dated 1486 and 1690 B.C. ± 200 were Mesa de Guaie Phase.[9] Occupation 11 (dated 236 A.D. ± 200 years) and 12 were of the Palmillas Phase.[10] In the front of the Cave there were four thick stratified beds of vegetal and artifactual materials separated by sterile ash and / or dust layers. The lower two, occupations 13 and 14 belong to the San Lorenzo Phase while 15 and 16 were of the San Antonio Phase.

Valenzuela Cave (Tm c 248) confirmed the stratigraphy of Tm c 247 and added considerably to our knowledge of the earlier phases. The earliest three lenses of refuse in Tm c 248 contained artifacts and vegetal materials of the Infiernillo Phase. The latest of these, occupation 3, was dated as 6244 BC ± 450 years old.[11] Occupation 4 through 5 were of the Ocampo Phase and occupation 5 was found to be 3694 B.C. ± 350.[12] Occupation 6 which was relatively brief and was of a new phase called Flacco and was dated as 1991 B.C. ± 334.[13] The next layer was fairly extensive and was of the San Lorenzo culture. The thin top stratum, occupation 8, contained San Antonio.artifacts.

7. Crabe and Griffin, 1958 M502 and M503
8. Ibid - M504 and M567
9. Ibid - M505
10. Ibid - M506 and M568
11. Ibid - M498
12. Ibid - M497
13. Libby, personal communication.

TABLE 1

TABLE 1

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Stratigraphy in Sierra Madre

Stratigraphy and Excavations in the Sierra de Tamaulipas

Tm c 248	Tm c 247	Tm c 274	Tm r 246	Combined Southern Tamaulipas Sequence (33 244 plant remains)	Tm c 81	Tm c 174	Tm c 82	Tm c 314	Tm c 315	Tm r 86	Tm r 79	Other Excavated sites
Occ.8-Zone A-Possible comp.	Occ.16-Zone A Prob.comp. *Occ.15-Zone B Pure comp. (337.artifacts) 2,892 plant			1750 A.D. San Antonio* Los Angeles* (3571 plant remains) 1300 A.D.	Layer 1-Zone A-pure comp. (246 artifacts)	surface-poss. comp. (C 14- 1292AD. 150	Layer 1- probable component Layer 2 " "	*Layer 1-Zone A-Pure comp. (672 artifacts) 724 plants)				Tm c 83-level 1-Pure comp. (63 artifacts) Tm c 83-levels 2-3-prob.comp.
* Occ. 7-Zone B-prob. comp.	*Occ.14-Zone C Pure Comp. (660 artifacts) 7,274 plants) *Occ.13-Zone D-Pure comp. (741.artifacts) 7,764 plants)	Layer 1 Zone A-Poss.comp. *Layer 2-Zone B-Pure comp. (331 artifacts) 771 plant) (C.14-1436.A.D..200		San Lorenzo* (15,754 900 A.D.								
				La Salta 500 A.D.				Layer 2 - possible comp.			Level 1-Floor-Pure comp. Level 2 " " " (1018.artifacts)	Tm r 78-house 1-Pure comp. (721 artifacts) Tm.r.78-house.2-prob.comp.
	*Occ.12-Zone E Pure comp. (169 artifacts) 1436 plants *Occ.11-Zone F Pure comp. (614 artifacts) 3,264 plant (C.14.236.A.D..200.)	*Layer 3 Zone C poss.comp. *Layer 4 " " " *Layer 5 Zone D Pure comp. (44 artifacts)	Level 1-3 pure comp (2019 artifacts	Palmillas* (4,700) Eslabones 0	Layer 2-Zone B-possicomp.		Layer 3-possible component			Level 1-3-possible comp. Level 3-Floor 1-Pure comp. (967 artifacts)	Levels 3-4-poss.comp.	Tm(r 6-houses-Pure comp. (3373 artifacts) Tm r 304-Nichelson's Pure comp. (over.10,000.artifacts)
				Laguna* 500 B.C. (1001)		*Layer 1-ZoneA poss.comp (1001 plants				Level 4-6-Floors-Pure comp. (1723 artifacts)		Tm r 172-houses-Pure comp. (1695 artifacts) Tm.r.88-.probable.comp.
	*Occ.10-Zone G Pure comp. (244 artifacts) 698 plants (C 14 1486 & 1690 A.D.) *Occ..9.Zone.I1-Prob.comp.			Mesa de Guaje* (698) 1400 B.C.								
	*Occ.8 Zone I-Pure comp. (318 artifacts) 380 plants Occ.7-Zone J1-prob.comp. *Occ.6-Zone J Pure comp. (61 artifacts) 142 plants (C 14 2700 B.C. 200 *Occ.5-Zone.K-prob.comp.			Guerra* (622) 1800 B.C.					Level 1-4 mixed			
* Occ.6-Zone θ-pure comp. (61 artifacts) 3,100 plant (C 14 1991 B.C. 334) Zone D ?		Layer 6-Zone E4-poss.comp. Layer 7-Zone E1-prob.comp. Layer 8-Zone F3-Pure comp. (49 artifacts) Layer 9-Zone F1-prob.comp. Layer 10-Zone F Pure comp (41 artifacts) Layer.11-Zone G1-prob.comp.		Almagre Flacco* (3,100) 2200 B.C.			Layer 4-probable component	Layer 3-probable comp.	Level 6,7,5-Zone C-2 Pure comp. (368 artifacts)			
* Occ.5-Zone E-Pure comp. (72 artifacts) 805 plants) (C 14 3694 B.C. ~~200~~ 353) Occ.4-Zone F prob.comp. * Occ.4-Zone G prob. comp.	*Occ.4-Zone L-pure comp (74 artifacts) 408 plants) (C 14 2604 B.C. ~~200~~ 350) *Occ.3-Zone M prob.comp *Occ.2-Zone N poss.comp (C.14.3244.B.C. ~~200~~ 350)			La Perra* (1780) 3000 B.C.		*Layer 2-ZoneB Pure comp *Layer 3-ZoneB " " (141 artifacts) 1780 plants (C.14.2492 B.C. 280	Layer 5-probable component		Level 8-9,Zone D-Pure comp. (61 artifacts)			
				Ocampo* Nogales (1213) 5000 B.C.	Layer 3-Zone B-prob.comp.	Layer 4-ZoneC mixed	Layers 6-7 prob. components	Layer 4-Zone D-Pure comp. (97 artifacts)				Tm c 29-probable component
* Occ.3-Zone H pure comp (41 artifacts) 620 plants) (C 14 6244 B.C. 450 *Occ.2-Zone I pure comp (92 artifacts) 185 plants) Occ.1-Zone J-poss.comp.	Occ. 1-Zone O-poss.comp	Layer 12-Zone G-pure comp. (24 artifacts) (C 14 6544 B.C. 400		Infiernillo* (805) 7000 B.C.	Layer 4 - mixed							
				Lerma 9000 B.C.	Layer 5-Zone C-Pure comp (50 artifacts) (C.14.7314.B.C..500.	Layers5-6-ZoneD-Pure (42 artifacts)						
				more than 10000 B.C. Diablo	Layer 6-Zone D poss.comp							

* = preserved vegetal remains

The final Cave Ojo de Aqua, (Tm c 274) had a deep deposit (6 to 8 feet) of refuse but only the upper San Lorenzo occupations 11 and 12 (dated 1436 A.D. ± 200) had preserved refuse.[14] Below it were three floors of the Palmillas Phase and then a series of charcoal floors, occupation 2 through 7 that belonged to the Flacco Phase. A small charcoal area, occupation 1, at the bottom of the deposit on top of gravels yielded Infiernillo artifacts and a date of 6544 B.C. ± 450.[15]

Thus, from the Sierra Madre was a sequence of eight cultural phases extending from roughly 7000 B.C. to 1750 A.D. There were few gaps in this sequence; only before and after Palmillas and between Infiernillo and Ocampo. But most important there were abundant vegetal food stuffs from all the cultural phases.

When the sequences from the two areas are compared it becomes immediately apparent that contemporary phases from the two areas are closely related. Thus, I have for purpose of this paper telescoped the two sequences to form a general one for southern Tamaulipas. By doing such, we are able to reconstruct an unbroken sequence from 8000 B.C. to 1750 A.D. and a sequence of 9000 years with preserved food remains. I am well aware that this combining of the two sequences has its limitations and that the cultures and environments were not exactly the same. I believe, however, that they are sufficiently similar to give a fairly accurate general picture of what the sequence for one or both actually was, particularly with reference to domesticated plants (see Table 1).

14. Crane and Griffin, 1958, M501
15. Ibid - M500

In the following paragraphs I shall briefly review the thirteen sequential cultural phases of prehistoric southern Tamaulipas, touching upon subsistence, settlement patterns and a few of the salient features of their material culture.

The Diablo complex which is estimated to be older than 12,000 years, is very poorly defined and represented by only a few bifacial ovoid large knives, pebbles and bifacial choppers and large flake, unifacial side scrapers or knives. The few associated bones (including those of a horse) and the relatively small areas occupied, suggest groups of primitive nomadic hunters.

The Lerma Phase, 8,800 to 10,000 years old, represented by seven components (three of which are good) seems to have had a community pattern which has been called Nomadic Micro-bands. The proportion of bones to cubic feet of refuse suggests that between 70 to 50 percent of their subsistence was based upon hunting with the rest on food gathering. The lenticular spear or dart points, snub-nosed and stemmed end-scrapers, large plano-convex ends and side scrapers, the gravers pebble choppers and ovoid or square based bifacial knives all can be connected with the chase or meat and skin preparation.

It is with the Infiernillo horizons 7,000 to 9,000 years old, however, that we obtain our first clear picture of ancient subsistence. These materials included abundant preserved vegetal matter. Fifty to seventy percent of the food stuff are from plant collecting, while from 45 to 25 percent are from hunting. The remainders (less than five percent) are from incipient agriculture of pumpkins, peppers and in the latter stage

gourds. Agave, Opuntia and runner beans, all potentially capable of being domesticated, were collected along with other wild plant remains. The various components indicate that they had a community pattern of Seasonal Micro-bands, that is bands from one to three families who were usually nomadic hunters, but during certain seasons when plants were ripe, settled down together in one spot to exploit these resources. In terms of material culture, diagnostic tools include tear-drop shaped, diamond shaped or large contracting pointed stem projectile points for attachment to spear shafts, or wooden dart foreshafts. Equally distinctive are a series of large scraping planes and flakes choppers or scrapers. Other traits include Fuegian nets or baskets,Z twisted hard yarn string with or without knots, simple nets with or without a rod foundation, twilled and plaited matts, some peculiar wound-element coiled baskets (that superficially look like twined baskets),several shell beads and awls with holes in their bases.

The next period from 3,000 to 5,000 B.C. seems to have been filled by Nogales of the Sierra de Tamaulipas (without preserved remains) and the early part of Ocampo (with preserved vegetal remains) from the Sierra Madre. From 70 to 80 percent of their subsistence was based on plant collection. Plants collected included Panicum sonorum (a millet), seteria runner beans (Phaesolus coccineus), Agave and opuntia, all of which could be domesticated but were not. Domesticated plants make up from 5 to 8 percent of the diet and included gourds, chili peppers, large and small varieties of pumpkin and yellow seed varieties of Phaesolus vulgaris. ~~Maze of the feces corn silk and pollen occurred but whether it was domesticated is not known.~~ The remainder~~d~~ came from hunting. Dart points for atlatl foreshafts include a subtriangular variety, an incipient stem variety (only in Ocampo)

and one that is tear-drop shaped. Other artifacts included large and small chipped bifacial disk (choppers), mullers, disk scrapers, Clear Fork type gouges, large flake end scrapers, full turned coil nets, checker-woven and twilled matts and twilled baskets, and Fuegian baskets as well as string often tied in a wide variety of knots. The community pattern seems to be Seasonal Macro-bands.

The next period from 3,000 to 2,200 B.C. is represented by the La Perra remains and the late Ocampo components. About 15 percent of their food came from animals while from 70 to 76 percent came from wild plants including amaranths, Panicium sonorum, Phaesolus coccineus, opuntia ,tripiscum and agave. There is a fairly wide variety of domesticated plants though they only compose from 10 to 15 percent of their diet. These include gourds, two varieties of squash, peppers, and long red and yellow seeded varieties of Phaesalos vulgaris. Present in La Perra were two varieties (A and B) of a corn race called Early Nal-tel. The settlenebt pattern is much like that of the previous period. Dart points include contracting stem, ssiub-triangular, tear-drop shaped and triangular with a concave base and a basal flute. Gouges, disks, choppers, mullers, pebble manos, disk scrapers, simple coiled nets, twilled and checked matts and baskets, string, full turned coiled nets and multiple stitch and warp baskets also occur.

The Flacco and Almagre Phases are the most similar of any from the two areas. It is estimated that they existed from 2,200 to 1,800 B.C. The subsistence is very much the same with only a little more agriculture 20 percent. This is at the expense of plant collecting, 65 percent. The only difference in terms of new crops is that the Bat Cave race of corn is to be found in Flacco. This occurrence of Bat Cave race after Early Nal-tel

is somewhat peculiar in that Bat Cave race is thought of being a more primitive type. Like the subsistance, the settlement pattern is very like the previous period. However, two sites of the Almagre Phase show a significant difference. One had wattle and daub in it, suggesting permanent houses while on other site encompased a large area suggesting (if all the area of occupation was contemporaneous) a village. Thus we have classified these cultures as being semi-sedentary Macro-bands. Artifacts included large stemmed, corner-notched, contracting stem with or without tanged shoulders, tear-drop shape and triangular atlatl points, keeled and snub-nosed end scrapers, blades and polyhedral cores, coiled, twined and twilled baskets, coiled nets, rabbit sticks, chipped gouges, twilled mats, string and ropes and a few pieces of string that might be cotton though most are agave. Mortars, boulders, metates and pebble manos are still present.

Developing out of Flacco is the Guerra Phase of the Sierra Madre which is not represented by many (only 6) components though it contained abundant artifacts and food remains. Carbon 14 dates suggest it was a short period from 1,400 to 1,800 B.C. The four open sites found suggest they lived in small villages while the cave occupations seem to have been of some duration; thus their community pattern was semi-permanent villages. Domesticated plants including gourds, peppers, pumpkins of two varieties, Cucurbita moschata (i.e. warty squash), yellow and red beans as well as cottons compose about 30 percent of their diet, only a tenth came from meat (10%) while the rest are wild plants. The changes in artifact types is not very great. Cornernotched, contracting stemmed and large or small triangular or leaf-shaped atlatl point occur

along with choppers, disk scrapers, gouges and small plano-convex endscrapers. Simple coiled nets, twined blankets, twilled matts and baskets, half-hitch woven baskets and mainly coiled baskets occurred. One difference is in the string that has many more varities than in the previous phases. Flexed burials under and over matts with basket were uncovered.

The Guerra phase developed directly into one called Mesa de Guaje (estimated as occurring from 500 to 1,400 B.C. based on Carbon 14 data). It is represented by even less components. However, what there was seems to show they lived in semi-sedentary villages. Agriculture including gourds, peppers, two varieties of pumpkins (Cucurbita pepo), yellow and red seeded beans, warty squash (Cucurbita moschata). Bat Cave and hybridized corn, teocentli, and cotton ~~and sunflower~~ composed about 40 percent of their diet. Hunting (10 percent) and plant collecting (50 percent) made up the rest of it. Projectile points include straight and contracting stem varieties, large and small triangular and leaf-shaped types and there were a number of foreshafts indicating these were used on darts. One of the more distinctive features of this phase was the making of black, red and plain pottery flat-bottomed bowls and small mouthed jars. (no appendage such as feet, handles or sprouts occurred.) A wide variety of twilled and checker woven matts occur usually with distinctive borders, split stich baskets in form of pans or waterbottles as well as coiled and lace nets, twilled 2/2 and 1/1 cotton loom made cloth, string choppers and scrapers.

The period developing out of Mesa de Guaje (called La Florida) was only found in survey on the Sierra Madre, but it seems very similar to Laguna of the Sierra de Tamaulipas which had domesticated plant remains.

These people were basically agriculturalists with 40 percent of their subsistence coming from these activities, 51 percent from plant collecting and about 9 percent from hunting or trapping of animals. Domesticated plants included gourds, pumpkins, manihot, pepper (?), beans (large red variety), cottons, three races of hybridized corn Breve de Padilla, Dzit-Bacal and Nal=tel and possibly earlier Nal-tel (unhybridized) types. (Possibly the other plants found in Mesa de Guaje exist at this stage also but our sample was too small to determine this.) Habitations are fairly extensive and I have considered the community pattern to "Sedentary Temple Oriented Village groups". That is, there were round platforms for wattle and daub houses that are associated with plaza and larger pyramids to form a ceremonial in village centers. These centers are surrounded by hamlets, camps or villages. There were wide variety of artifacts manufactured of which the most numerous was ceramics. Six monochrome wares predominate which were: fine cream, fine orange, polished black, polished red, brushed and plain. These have wide variety of forms including tripod, effigy and flanged vessels. Also made of clay were modelled figurines, ladles, whistles and clay dishes. Twilled cotton cloth woven on a belt loom, twilled matts, twined bracelets, split-stitch coiled baskets, and a number of varities of string were common. Ground stone included celts, adzes, mullers, cylindrical and rectangular manos, angled back metates, bell-shaped pestles, mortars and bark beaters. Chipped stone was relatively rare but included prismatic flakes struck from cylindrical polyhedral cores; stemmed, side-notched and corner-notched atlatl points and large ovoid bifaces.

This late Formative Phase is directly ancestral to Eslabones of the Sierra de Tamaulipas which overlaps with early Palmillas of the

Sierra Madre, roughly from 0 to 500 A.D. Since only Palmillas had preserved vegetal remains our reconstruction is based upon these materials. Domesticated plants included several varieties of corn, pumpkin, moschata and mixed squash, gourds, chili peppers, probably tobacco, runner beans, sunflowers, panicium, amaranths, manihot, lima beans, six varieties of common beans and cotton. Domesticated plants represented about 45 percent of their diet and wild plant collecting 50 percent while the remainder was from hunting or trapping of animals. This was the period of the greatest population concentration. Numerous (one has 1,400) house platforms are found grouped around rectangular plaza outlined by pyramids at a number of sites. Sometimes ball courts, tanques and other architectural features are associated. These seem to be ceremonial centres or towns and often are on the tops of hills. Other sites are small areas of habitations that perhaps represents hamlets, village or camps. While the basic community pattern is much like in the former phase, the centers are larger and more complex. This is, also true of the rest of the material culture, The ceramics of red, black, plain and brushed wares are better made, more decorated (often by engravings) and appear in a wider variety of vessel forms. Figurines are both mold-made and modelled. Elbow pipes, ladles, discoided, beads and other objects are also made of clay. Mats, nets, cloth and baskets are ornate and numerous. The few ground and chipped stone tools are much like those of the previous phase.

La Salta, (500 to 900 A.D.) developed from Eslabones and if we can judge from late Palmillas remains which are very similar, it would seem that these subsistence patterns were about the same. The settlement pattern

is somewhat different in that many of the sites with stone house platforms have no temples and that sites, generally speaking, are smaller. The material culture also seems to be less complex. There are only four kinds of ware, polished black and plan and smooth and brushed utilitarian ware. Figurines which are mold-made are not numerous. Ground stone sees only celts, metates, manos, mortars and pestles. Chipped stone sees not only stemmed, side-notched and corner-notch attach points but also arrow points with the same forms but smaller sizes. Scrapers, knives, prismatic blades and cores still occur. If we can project from the late Palmillas remains, ornate mats, nets, woven cloth and split-stitch baskets still occurred as well as clay elbow pipes. Cane cigarettes and arrow shafts are also present.

In the Sierra Madre, San Lorenzo developed from Palmillas but the regional equivalent has not been found in the Sierra de Tamaulipas. San Lorenzo (900-1300 A.D.) has most of the domesticated plants of Palmillas but some of the varieties of Zea Mays and Cucurbita pepo as well as panicum, teocentli and sunflower are missing. Furthermore, agricultural foods represent only 40 percent of their diet while 10 percent is from meat. Perhaps the noticeable difference is that few stone architectural remains have been uncovered though wattle and daub houses were used. Also, the few sites we have found are smaller and are without any pyramids or obvious ceremonial structures. The material culture is also simpler. Pottery is confined to a few types with polishing, corrugating, engraving, smoothening and brushing. These are relatively poorly fired and have a limited number of vessel forms and no vessel appendages. Figurines are absent but clay pipes and spindle whorls appear.

Ground stones metates, cylindrical and rectangular manos and rectangular manos and a possible adze. Coiled and laced netting appear as do twilled cloth undecorated mats, skin belts and bags, split stitch baskets and cigarettes appear. It is this period that various leaf, serrated, corner notched, side notched and triagular arrow points outnumber atlatl points. Prismatic blades are rare but small end scrapers, bifaces and choppers are fairly numerous.

The final period (1300 to 1750 A.D.) sees the Los Angeles Phase in the Sierre de Tamaulipas and San Antonio in the Sierra Madre. Both of these last into historic time. Study of food reveal that these people obtained 40 percent of their food from agriculture, 42 percent from wild food plants and 18 percent from animals they hunted or trapped. Variety of domesticated plants are limited to one or two varieties of corn and beans, peppers Cucurbita pepo and Moschata, gourds, cotton, tobacco, Indigo and possibly canavalia beans. Sites are uniformly small though fairly numerous and seem to have been small rancheros with a few wattle and daub oval houses. Caves were again fairly extensively occupied. Pottery is more poorly made, less decorated, more limited as to vessel form and is brushed, smoothed or burnished black. Mats, nets and split-stitch baskets still appear. Flat rectangular metates and manos, pestlas of clay or stone and stone mortars occur. The bow and arrow is dominant over the atlatl and dart and a whole series of small notched and triangular chipped points occur. Chipped stone choppers, knives and scrapers again become common. Generally speaking, however, this phase seems to be much less complex and sophisticated than the previous three or four periods.

TABLE 2

Having briefly reviewed the combined archaeological sequence of southern Tamaulipas, let us reiterate the sequence of domesticated or potentially domesticated plants. Agave,[16] opuntia[17] ~~and~~ Phaseolus coccineus[18] (runner beans) were used from the beginning of the sequence (9,000 years ago) and last up until historic times. There seems to be no evidence botanically that these were consciously planted or cultivated, though the plants were capable of such. Other plants capable of domestication, but for which we have no actual evidence that they were domesticated were Panicum sonora (millet) that appear in feces from 5,000 B.C.[19] through Palmillas 700 A.D., Amaranths that occur in refuse and feces from Flacco (1,200 B.C.) times to historic times,[20] and seeds and beans of manihot dulcis[21] in the refuse from Laguna times (500 B.C.) through Palmillas times (700 A.D.). Also, occurring in the Laguna Phase were remains of Bromelia[22] which in certain parts of Mexico were planted as hedges and their acid fruits eaten.[23] However, their rarity in the Tamaulipas remains strongly suggest they were not planted here and were collected along with other wild forms. Some pods that might possibly be Canavelia occurred with Los Angeles remains but whether they are Canavelia is not certain.[24]

Now let us turn to the plants that actually seem to have been domesticated. Two of the earliest at 6,000 B.C. and leading to historic times are the gourd, (Lageneria sic)[25] and chili peppers, (Capsicum frutescens)[26]

16. Dressler personal communication.
17. Ibid.
18. Kaplan and MacNeish, in press.
19. Callen and MacNeish, in press.
20. Ibid.
21. MacNeish, 1958.
22. Ibid.
23. Dressler, 1953, pg.125.
24. Kaplan, personal communication.
25. Whittaker, Cutler and MacNeish, 1957
26. Callen and MacNeish, in press.

Both of these could have been useful weeds that were exploited but not planted. Some botanists, however, do not believe these plants occur wild, but are either domesticated or plants that once were domesticated and have returned to a wild state.[27/] As far as Tamaulipas is concerned, both are rare or absent in a wild state and very frequent in the archaeological remains. Thus I believe both were planted.

As early as these plants are domesticated pumpkins (Cucurbita pepo). These first occur in early Infiernillo levels, perhaps 9,000 years ago and last until historic times. According to Whittaker and Cutler there were an increase of varities of pumpkins until Palmillas times.[28/] Unfortunately our archaeological material was not complete enough for them to set up actual races of Cucurbita pepo in their analysis. In rough outline the sequence of varieties was as follows. In the beginning there was a small (seeded) pumpkin. During Ocampo and La Perra times a slightly large seeded variety occurred with a narrow tapering penduncle. In Mesa de Guaje a wide-rimmed seed variety occurred and the greatest diversity was reached in Palmillas when one or more varieties occurred with not only different shaped seeds, but very different stems and body forms. Warty squash (Cucurbita moschata) first occurred during Guerra times about 1,800 B.C. and walnut squash (Cucurbita mixta) during Palmillas 300 A.D. Both lasted up until at least 1300 A.D.[29/]

Following the earliest peppers, squash and gourds, are beans (Phaesolus vulgaris). The first beans are yellow seed variety (C 31) which occurs in early Ocampo about 4,000 B.C. which are shortly followed by a long red variety (C 33) about 3,000 B.C. These lasted up until

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27. Dressler, 1953, pg. 126-127.
28. Whittaker, Cutler and MacNeish, 1957.
29. Ibid.

historic times. Since, no wild beans have been found in Tamaulipas, it is assumed they were domesticated throughout their history even though in the earlier stage they were treated much like a wild plant, that is, pods and beans were chewed as quids and mainly green beans were utilized without being boiled. During Palmillas times 300 to 800 A.D. two other varieties of Phaesolus vulgaris, a black bean (C 32) and a small red bean (C 33a) occurred along with lima beans (Phaesolus lunatus).[30]

Occurring only a short time after the first beans is corn (Zea Mays). Its use starts about 3,000 B.C. and it lasts until today. Here again, new or distinctive races appear at different time periods. Unfortunately only the corn sequence from the Sierra de Tamaulipas has been completely studied[31] though the many cobs from the Sierra Madre are undergoing analysis. The earliest races are Early Nal-tel A and B in Sierra de Tamaulipas at 3,000 B.C. though pollen and silk may occur in earlier Ocampo feces.[32] Some cobs that are either of the Bat Cave race or closely related occur at about 2,000 B.C. in the Sierra Madre.[33] Occuring at about 1,500 B.C. were found a number of other varities (races) of corn showing teocenti introgression as well as actual grain of teocenti (though examples of one of its ancestors, tripiseum, occurred much earlier). Between 500 B.C. and the time of Christ Nal-tel, Breve de Padilla, Dzit-Bacal were found. Other races may occur in later phases, but by late Prehistoric and historic times Breve de Padilla type seems to have become dominant.[34]

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30. Kaplan and MacNeish, in press.
31. Mangelsdorf, MacNeish and Galinat, 1956.
32. Callen and MacNeish, in press.
33. Mangelsdorf and Reeves, 1959, pg. 424
34. Mangelsdorf, MacNeish and Galinat, 1956.

Besides these more well-known domesticated plants others occurred including: cotton (gossypium)[35] from 1,800 B.C. to historic times; possibly sunflowers (helianthus)[36] from 1,500 B.C. to 1,000 A.D.; possibly tobacco from 300 A.D. to historic times (nicotiana rustica); (here I say possibly tobacco for the leaves and stem fragments in pipes and cigarettes are small and difficult to identify accurately); and finally, evidence from dyed indigo blue fibre of fragments of woven cotton cloth indicate Indigofera suffruticosa was used in the period from 1,300 to 1,750 A.D.[37]

Thus all in all twelve definite species or genera of domesticated plants occurred as well as more than sixteen races of varities of these species. Furthermore, seven species of genera occurred that could have been domesticated. In total there are at least 34 domesticable plant varieties in the 9,000 year sequence from southern Tamaulipas.

When these dated domesticated plants from Tamaulipas are compared with other tentatively date plant remains from North and South America, they throw considerable light upon the origin and diffusion of many New World plants. It is actually rather surprising how many areas have given us dated domesticated plant remains in the New World. First and foremost are these from South America, mainly coastal that is from Huaca Prieta and the other parts of that Peruvian sequence.[38] Here we have a 5,000 year sequence of domesticated plants. Coming further north we have

35.I.Johnson, personal communication.
36. Callen and MacNeish
37. I. Johnson, personal communication.
38. Bennett and Bird, 1949.

just a hint of domesticated plants from Santa Marta cave in Chiapas.[39] ~~In~~ Recently in southern Puebla, a test in a rockshelter has revealed a long, but poorly represented sequence of plants. In Central Mexico we have not found early domesticated plants. The next area further north which produced long cave sequence some plant remains is in northwestern Mexico in Sonora[40] and in north Central Mexico in Coahuila.[41] The Southwest, particularly the Anasazi region, is abundant with preserved materials from caves; most of these are quite well dated.[42] In the Hohokam area there is, of course, Ventana cave,[43] / Tularosa cave, as well as others. In the Mollogon area there is Bat cave[44] Cordova cave,[45] and the Hueco caves.[46] Ajacent to the Mollogan remains are those from west Texas in the Big Bend area.[47] Present work in this area is contributing valuable new important information. Turning westward from the southwest we have remains from Gypsum cave,[48] Lovelock cave,[49] and other California caves.[50] Some of these are again C-14 dated, though they contained a fairly limited amount of domesticated plant remains. Going eastward we have first the Caddo area. There are two sets of information from this general region, one being from the rock shelters of the Ozark Bluff dwellers,[51] and the other being from charred remains in open Caddo sites.[52] Northward, in the Great Plains our material is very limited being mainly charred material from at the earliest Sterns Creek[53] and mainly Mississippi time period sites.[54] The eastern United States again has produced relatively limited material. The earliest seems to come from the vestibule of Mammoth cave in Kentucky and seems to be archaic, in other words, it is probably older that 2,000 B.C.[55]

39. MacNeish and Petersen, in press.
40. Mangelsdorf and Lister, 1956.
41. W. Taylor, 1956 and Aveleyra, 1956.
42. Kidder and Guernsey, 1919.
43. Haung, 1950.
44. C.G. Smith, 1950.
45. Martin et al, 1952.
46. Cosgrove, 1947.
47. See Kelley, Campbell & Lehmer, 1940
48. Harrington, 1933
49. Loud and Harrington, 1929.
50. Heizer, 1951.
51. Harrington, 1924.
52. Newell and Knieger, 1949; Knieger.
53. W.D. Strong, 1935.
54. Wedel, in press.
55. N. Nelson, 19..

Many of the other Kentucky caves which Webb noted seem to be of the Adena time period.[56] Other remains from the eastern United States come from open sites and are mainly charred materials, a few of which come from the Hopewell time level[57] but most of them belong to the Mississippi time period.[58]

Now let us take some of the domesticated plants from Tamaulipas, compare their occurrence with those from other parts of the New World, and see what they tell us about contacts between Meso-America and the United States. The first plant we shall take is the common gourd (Lagenaria sic.). Whittaker and Carter have indicated that its ultimate origin probably is in Africa and that it probably floated across the Atlantic Ocean and may have taken hold again in the soil along the edge of the Atlantic coast of the New World.[59] As indicated in Tamaulipas it is at least 9,000 years old in the New World. In the eastern United States (if we can trust the Kentucky cave material) it is in the earliest levels,[60] in Huaca Prieta it is in the earliest levels,[61] and in the Southwest of Bat cave it is in the earliest levels.[62] It is here suggested that probably even during the Pleistocene gourds were floating across from Africa and taking hold along the Atlantic coast, and growing wild, ~~and that~~ Then with the invasion of men to the Atlantic coast more that perhaps 9,000 years ago, they began to be used by a number of different groups in this vast area. Later their use spread from the Atlantic coast westward. Thus from our present data and in terms of the above hypothesis, this plant is of little use in discerning prehistoric contacts.

[56] Webb and Baby, 1957
[57] T. Devel, 1952.
[58] J. Griffin, 1952.
[59] Towle, 1952; Whittaker and Carter, 1954.
[60] Funkhouser and Webb, 1929.
[61] Bennett and Bird, 1949.
[62] Smith, 1950.

Chili peppers, that is Capsicum frutiscens represent a somewhat similar problem. These are probably wild in the New World, and wild chili peppers are spread from the American Southwest well down into Brazil in South America.[63] These also occur in the earliest levels in South America[64] and in the earliest levels in Tamaulipas. In other words, there is considerable reason to believe that these were one of the first food plants gathered and perhaps planted, perhaps again more than 9,000 years ago. Dressler has suggested that they probably were independently domesticated and used in a number of areas from Mexico down into Brazil.[65] Certainly the archaeological evidence would seem to back this up. The plant itself, of course, needs very little cultivation and is actually treated very much like a wild berry anyway. Furthermore, the wild plant and the domesticated one are very difficult to tell apart, particularly from archaeological remains. Thus this plant is also not very useful in plotting contacts. This, also is true of amaranths that appear early in Mexico, the Southwest and the East, but may very well have been independently domesticated a number of times.[66]

The next plant on our list, the pumpkin, that is Cucurbita pepo. (See Map.) These occur in Tamaulipas at about 8,000 to 9,000 years ago. They do not occur early in South America, nor did we find any in the caves in Chiapas in southern Mexico. However, they do occur in the earliest levels in the southwest of Bat cave.[67] They do not occur in Lovelock cave or other sites in the Great Basin. They are also absent from archaic remains in the Kentucky caves but do occur with Adena.[68] Since

[63] Dressler, 1953.
[64] Whittaker and Bird, 1949
[65] Dressler, 1953.
[66] Ibid.
[67] Smith, 1950
[68] Webb and Baby, 1957

Cucurbita texana is considered to be the most closely related wild plant and since it occurred between the Southwest and Tamaulipas, I would guess this is the area of domestication.[69] Our Tamaulipas Materials, particularly the small seed variety, appear to be very close to the ancestral type and indicate Tamaulipas was close to the centre of origin of our first pumpkins.[70] Thus, a date of 8,500 years ago is probably not too far from the actual date when they were first planted and domesticated. Somewhat confirming this hypothesis is their possible early occurrence in the Big Bend area. I say possible because all I have is a verbal statement about the recent Big Bend excavations. I would guess, that by 3,000 B.C. large seed varieties spread into the Southwest, into the Mollogon area[71] via the Rio Grande Route. About 2,000 B.C. these remains moved eastward across Texas into the eastern United States,[72] and southward to be utilized in the so called Formative period of Mexico. Pumpkin also appears in the lower Missouri in Stern Greek culture, about 500 A.D.[73] At a much later date, perhaps 1,000 A.D. they moved into northern Arizona (and perhaps the Hohokam area) from the Mollogon,[74] and during Mississippi times moved out into the Great Plains from the Woodlands. This is one of our best documented plants and also one, which I believe, we have some fair understanding of its origin and diffusion.

The history of beans, that is Phaesolus vulgaris, is not quite so well known. (See map.) However, in this case an actual wild variety is known from Guatemala and southernmost Mexico.[75] The early date of beans in Tamaulipas, that is about 4,000 B.C., suggests that

Tehuacan data

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[69] Dressler, 1953.

[70] Whittaker, Cutler and MacNeish, 1957.

[71] Smith, 1949.

[72] Webb and Baby, 1957.

[73] Strong, 1935.

[74] Carter, 1945.

[75] Dressler, 1953.

beans were domesticated perhaps between 4,000 and 6,000 B.C. in the Guatemala highland region.[76] but the Tamaulipas could have been wild. Our early date in Tamaulipas suggests that in pre-Formative time, that is roughly 3,000 to 4,000 B.C., they had spread over much of Mexico. The Bat cave materials suggest that by 1,000 B.C., they perhaps spread up from Tamaulipas via the Rio Grande into the Mollogon area of the Southwest.[77] However, their absence in Big Bend area at an early date may mean another route was used which was not along the west coast as they are also absent from Chihuahua and Sonora caves.[78] About the time of Christ there was a further spread across Texas from the southwest into the eastern United States to appear in Hopewell.[79] By about 1,000 A.D. they again moved northward; this time out into the Great Plains[80] and into the Iroquois area in the eastern United States.[81]

Warty squash (Cucurbita moschata) represents an entirely different problem. (See map.) It occurred in Tamaulipas and Peru about the same time, that is about 2,000 B.C.[82] but This is earlier than anywhere else in the New World. This suggests that its origin was somewhere between these two spots. As Dressler has stated, its greatest diversity is in Central America, and this may very well be its centre of origin[83]; on the basis of the dates for Peru and Tamaulipas we might guess that it was domesticated and first planted in that area about ~~3~~4,000 B.C. Then it spread north and south, reaching Tamaulipas by 2,000 B.C. and Huaca Prieta in Peru at about the same time. There are three possibilities as to

wild Teh

now in Tehuacan at 6000

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76. Kaplan and MacNeish, n.d.69.
77. Smith, 1949.
78. Mangelsdorf and Lister, 1956.
79. Devel, 1952.
80. Wedel
81. Ritchie, 1944.
82. Whittaker, Carter and MacNeish, 1957.
83. Dressler, 1953.

what happened next. It may have spread into the Southwest via the Rio Grande route to reach the Anasazi via the Pecos River at about 1,000 A.D., and then after this date it probably spread southward into the rest of the Southwest and also crossed Oklahoma and Arkansas to the Mississippi cultures in the eastern United States. Its absence in Mollogon, the Big Bend and its presence in the Ozarks[84] make this unlikely. The second possibility that it was independently domesticated in the East and then spread to the Anasazi of the Southwest, seems unlikely as it is absent in Adena.[85] The most likely hypothesis is that it spread from Tamaulipas to the Caddo area about the time of Christ and then moved westward to the Anasazi of Arizona at 1,000 A.D.,[86] After that spreading to the rest of the east and southwest.

Now we come to the most important New World product, that is corn (Zea mays). (See map.) This, of course, was the basis for all New World civilization and was really the most important agricultural plant. As yet, we know very little of its ultimate origin in spite of the fact that we have now found wild corn pollen in the valley of Mexico probably during the last part of the ice age and well as the beginning of the post glacial optionum.[87] This latter corn pollen which is probably domesticated is probably 7,200 years old. This is earlier than tha~~t from Santa~~ anywhere else. Marta, ~~Chiapas, in southernmost Mexico, where it has been found in a layer~~ between ~~4,000 to 6,000 years old.~~[89] Since this is about the date of corn found to the north of the Central Mexican Plateau this seems to hint that its origin was between Chiapas, Tamaulipas and Sonora. The next earliest corn is to be found in Tamaulipas, the Southwest and Sonora

Tehuacan

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84. Gilmore
85. Webb and Baby.
86. Whittaker, Cutler and MacNeish, 1957.
87. Barghoom, Wolfe and Clisby, 1954.
88. Clisby and Sears, 1955.
89. MacNeish and Petersen, in press.

at about 5,000 years ago. The former is the early Nal-tel type,[90] while at the latter from Sonora[91] and New Mexico[92] are a similar pod-pop type which is called Bat cave race. This suggests that the hypothetical early Central Mexican type became adapted to the mountains in one variety (the Bat cave variety) and spread up to western Cordilleron to New Mexico, while another variety of the early type had become adapted to the lowland and spread up the Gulf coast to Tamaulipas. From 1,000 to 2,000 B.C., corn seems to have been spreading into western South America.[93] At the same time, hybridized teocenti introgressed types began to appear in Mexico. These hybridized types in turn spread by about 1,000 B.C. to the Southwest.[94] By the time of Christ a special flint-type of corn became developed in the Basket-Maker culture of Northeastern Arizona, and this in turn crossed to the eastern United States and arrived in Hopewell area about the time of Christ.[95] At about 500 A.D. Nal-tel may have spread from Tamaulipas to the Alto focus of east Texas,[96] if the Alto focus identification is correct, ~~while~~ further hybridized types are spreading from Mexico into the Southwest from the western part of Mexico. After 1,000 A.D. eastern corn types spread into the Northeast[97] and up the Missouri into the Great Plains.[98] Though we are a long way from knowing all the answers about the spread of corn, I think that now we have at least a vague outline of its movements.

The next plant on our list is cotton (Gossypium). (See map.) The earliest cotton that has been found sofar is at Huaca Prieta in coastal Peru, its date from about 2,500 B.C.[99] Probably it is much older

woody
2 kinds

[90] Mangelsdorf, MacNeish and Gal~~e~~inat, 1956.
[91] Mangelsdorf, and Lister, 1956.
[92] Mangelsdorf and Smith, 1949.
[93] Bennett and Bird, 1949.
[94] Mangelsdorf and Reeves, 1959.
[95] Jones.
[96] Krieger, 1946.
[97] Ritchie, 1944
[98] Wedel, in press.
[99] Bennett and Bird, 1949.

/ diffuser cotton

in this area. It does not appear in Tamaulipas until 1,700 B.C. Between 1,000 B.C. and the time of Christ one movement of cotton seems to have extended northward in the central plateau of Mexico into the Mogollon of the Southwest.[100] Another finger, about the same time, may have moved from Tamaulipas across Texas to join the Hopewell and other Middle Woodland cultures of the eastern United States.[101] This, however, is very uncertain. Thus by the time of Christ, cotton seems to have reached its maximum distribution.

The next on our list as far as Tamaulipas is concerned is lima beans, that is Phaesolus lunatus. (See map.) Mackie has written quite a bit about the history of beans and seems to be correct in guessing that the place of origin was Guatemala.[102] Our first beans in Tamaulipas / appear between 1,500 and 1,000 B.C. Thus the first spread of beans from Guatemala seems to be northward over much of Meso-America. A second root seems to move between 1,000 and 500 B.C. down to Peru.[103] At about the time of Christ still a third finger moves out from Guatemala, southward and along the Caribbean, into Venezuela and out into the Caribbean Islands.[104] The Mexican varieties at about 500 A.D. move up the west coast to enter the Mogollon and Hohokam in the Southwest.[105] At about 1,000 A.D. lima beans spread northward into the Anasazi area of the Southwest.[106]

root
finger

~~Sunflowers, that is helianthus, probably have their origin in the Southwest (or between the Southwest and the Ozark Bluff dweller, if the few seeds from Ozark Bluff actually are pre-Pottery). Sunflower seeds appear in the earliest level of Bat cave which, I would guess, are about 3,000 B.C.~~[107]

100. Martin et al, 1952.
101. Dewel, 1952.
102. W.W. Mackie, 1943.
103. Bennett and Bird, 1949.
104. Dressler, 1953.
105. Kaplan, 1956.
106. Ibid.
107. Smith, 1950.

(See map.) ~~I also would guess, that sunflowers first spread eastward into the eastern United States to appear in Adena[108] and later in Hopewell.[109] At about the time of Christ, sunflowers start their southward movement, arriving in Tamaulipas about 300 A.D. At a much later date, about 1,000 A.D. they probably move up the Missouri River into the Great Plains and also at the same time move into the northeastern~~ United States.

Walnut~~t~~ squash, that is Cucurbita mixta occur in Tamaulipas and Ventana Cave in the Southwest at about 300 A.D. (See map.)[110] On the basis of this distribution I would guess that somewhere about the time of Christ Cucurbita mixta is domesticated in northwest Mexico. It probably spread from the Hohokam area into northeastern Arizona about 1,200 A.D., and at the same time was spreading out of northern Meso-America into Guatemala.

The final plant we shall discuss is tobacco. (See map.) The earliest tobacco that has been found sofar is from Adena caves in Kentucky where it occurs at about 1,000 B.C.[111] Working on the assumption that elbow and platform pipes were used for smoking tobacco, we might guess that during the Hopewell period about the time of Christ, tobacco spread all over all the eastern United States as well as up the Missouri River into the Plains. At about 500 A.D., tobacco smoking may have moved from the Caddo area of Texas into northeastern Mexico and then spread into the rest of Mexico during the post-Classic period.[112] Parallel with this movement would be a spread of tobacco from the eastern United States across Oklahoma and Kansas to the Southwest at about 500 to 700 A.D.[113] and then down the west coast in Mexico at 1,000 A.D.[114] Still later,

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[108] Webb and Baby, 1957.

[109] Devel, 1952, Gilmore, 1931.

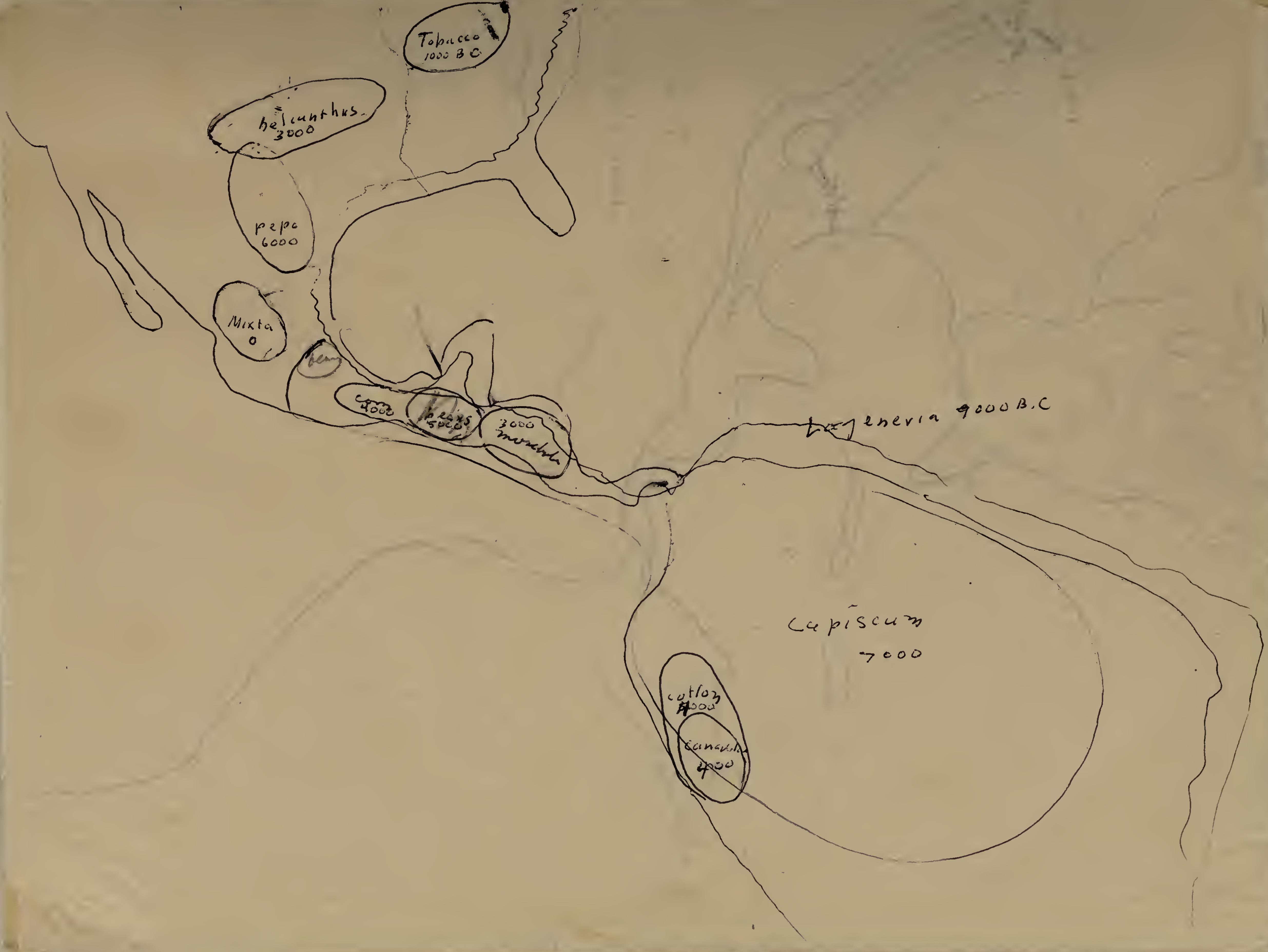
[110] Whittaker, Cutler and MacNeish, 1957.

[111] Webb and Baby, 1957.

[112] M. Porter, 1950.

[113] Griffin,

[114] Porter, 1950.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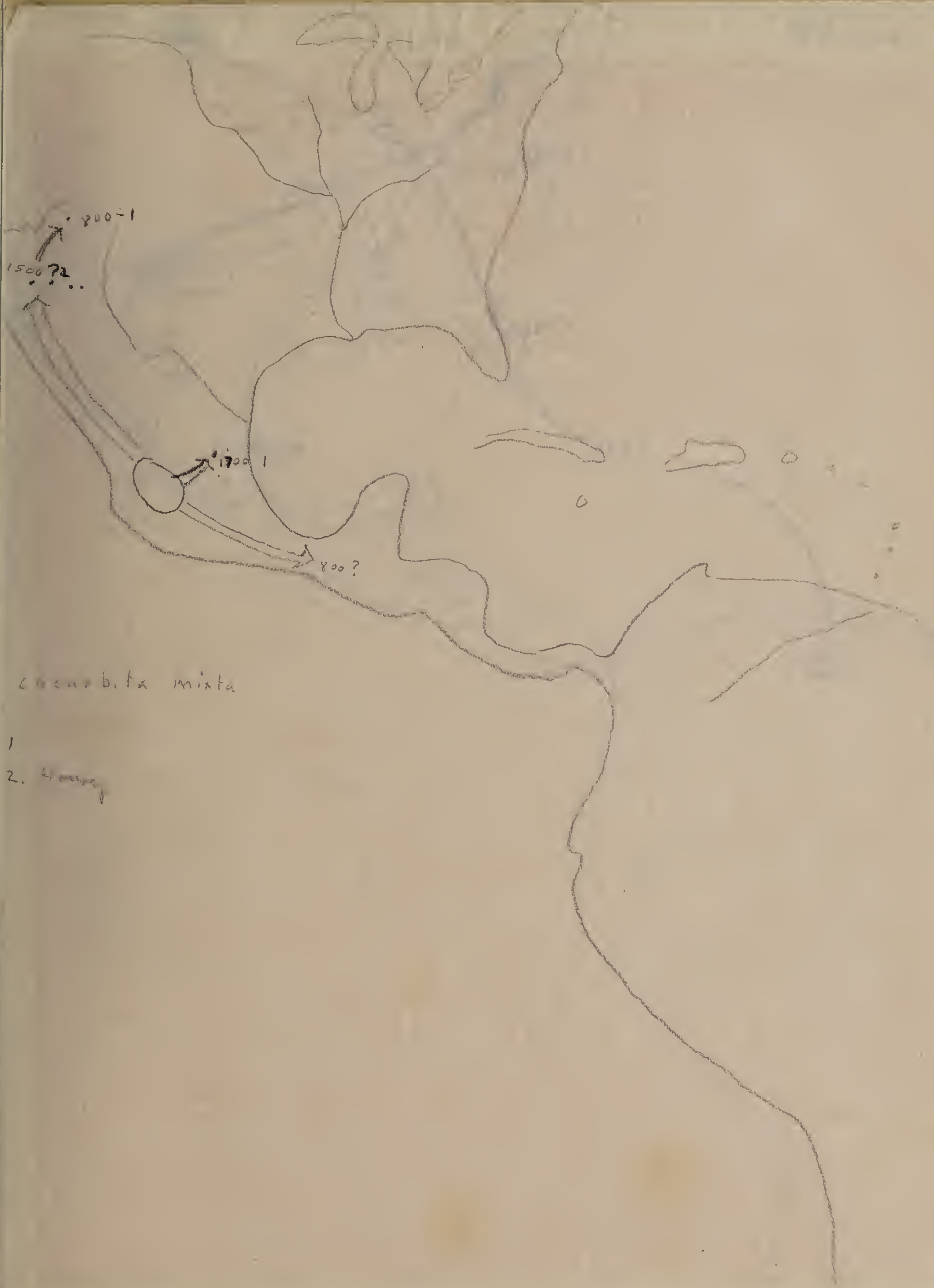

Cucurbita mixta

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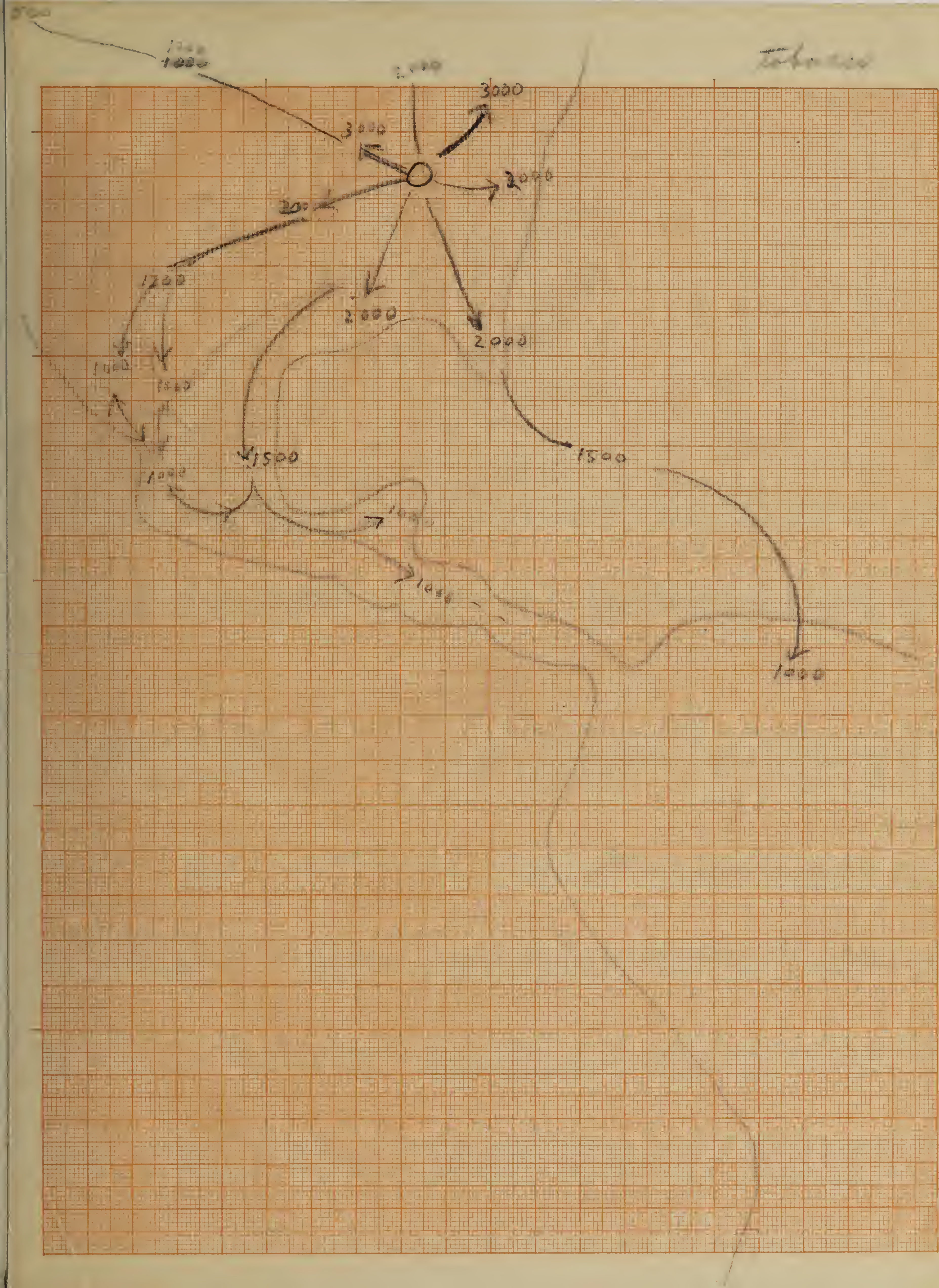
2. Henry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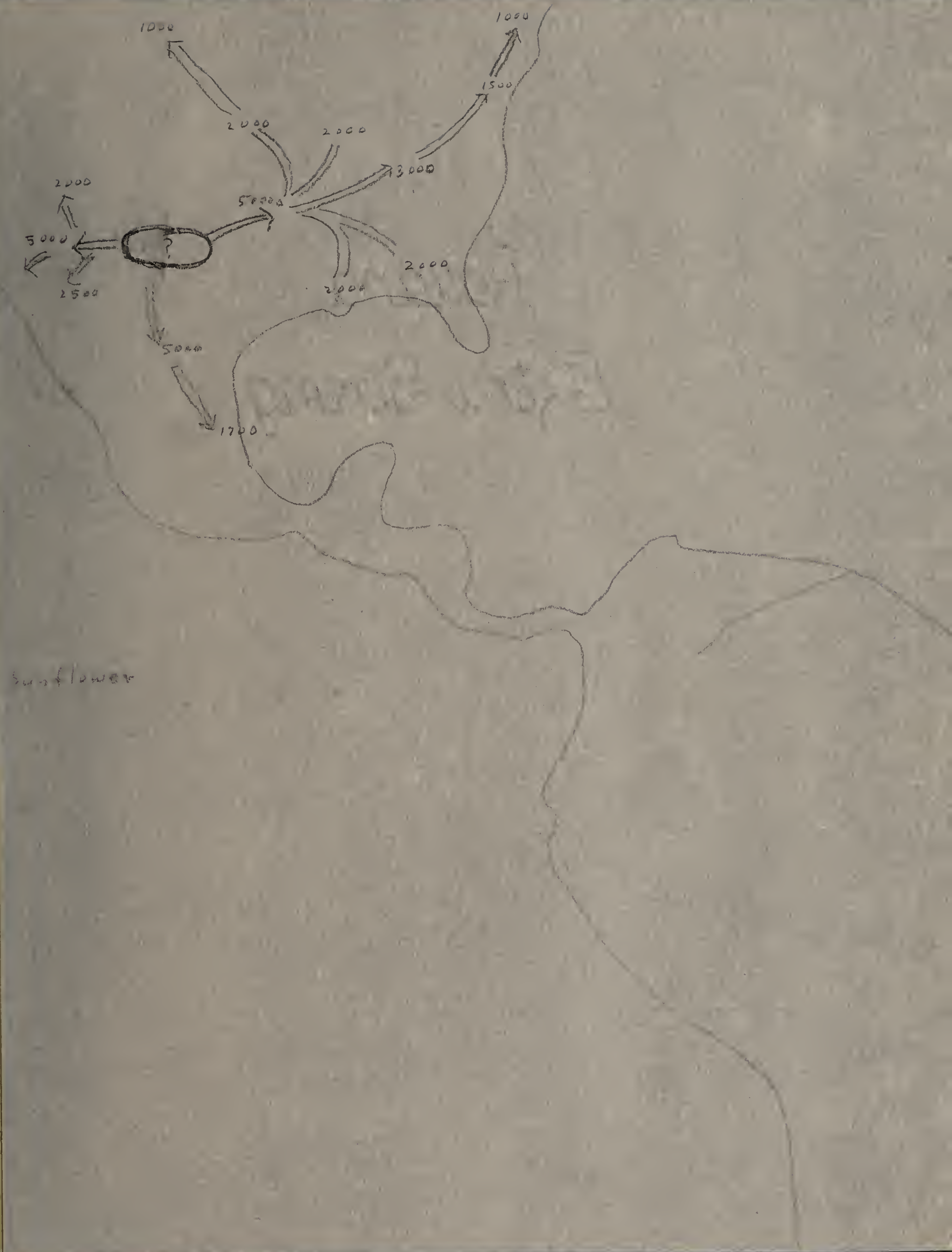
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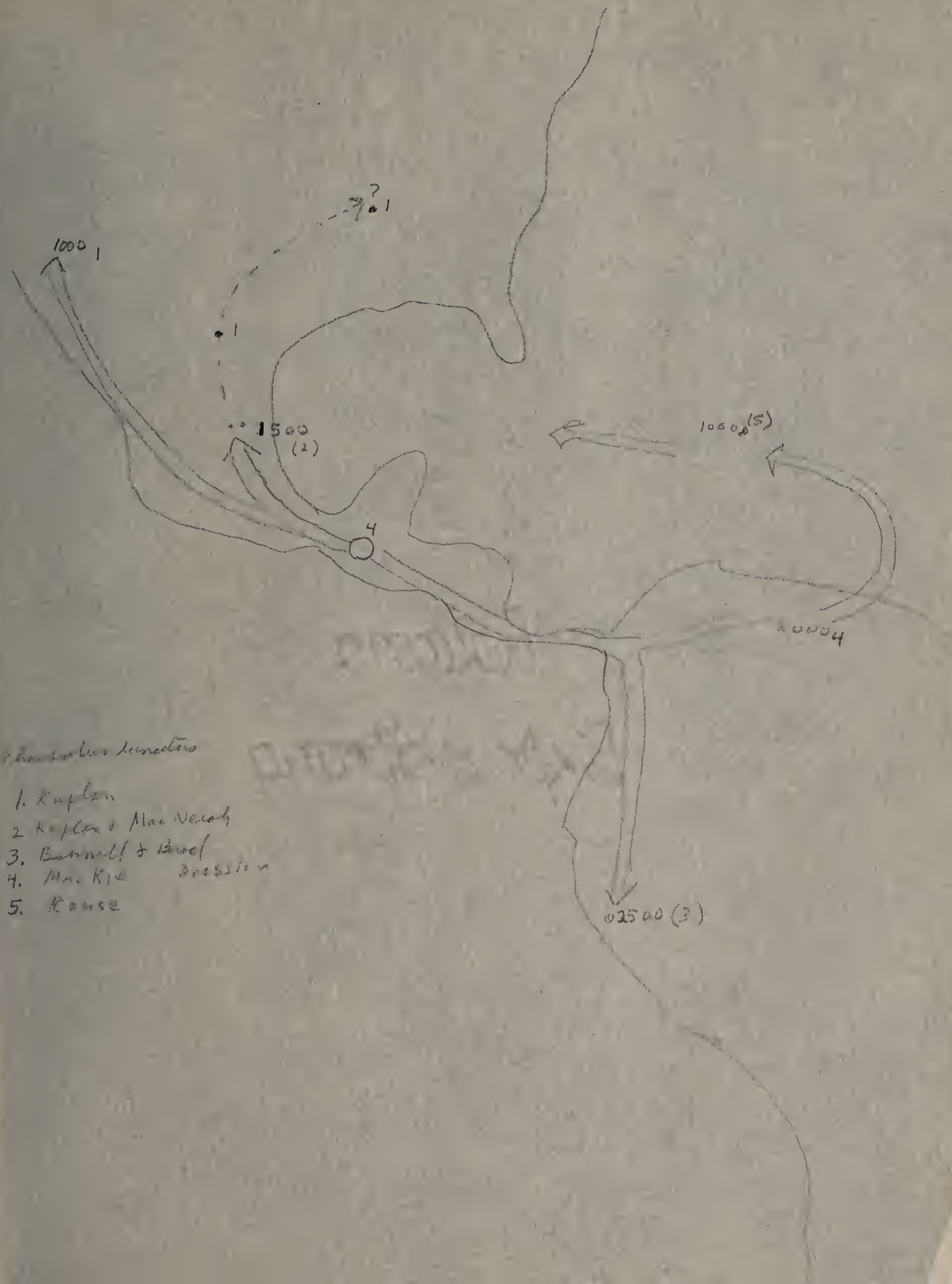? • 1
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4. MacKie   Dressler
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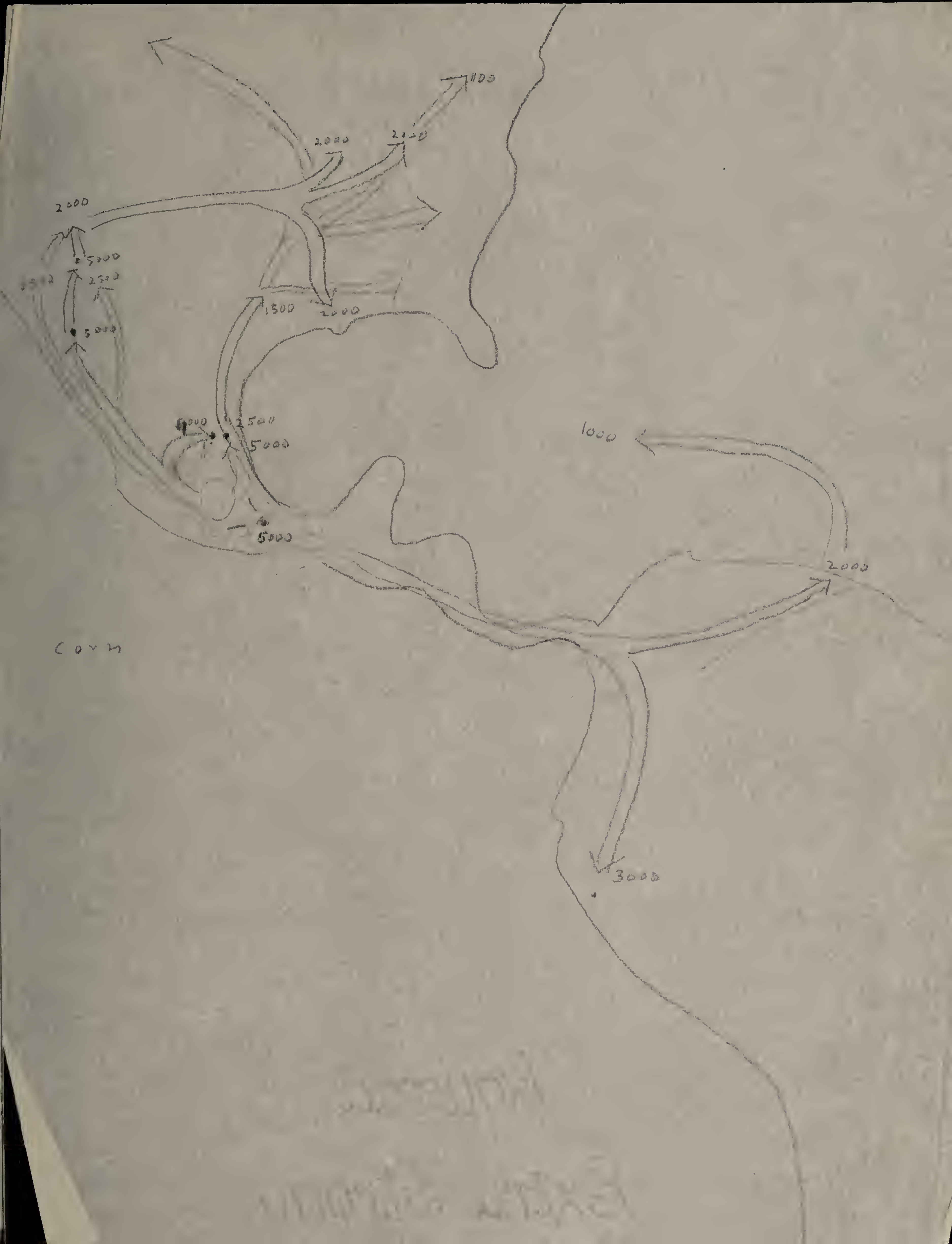
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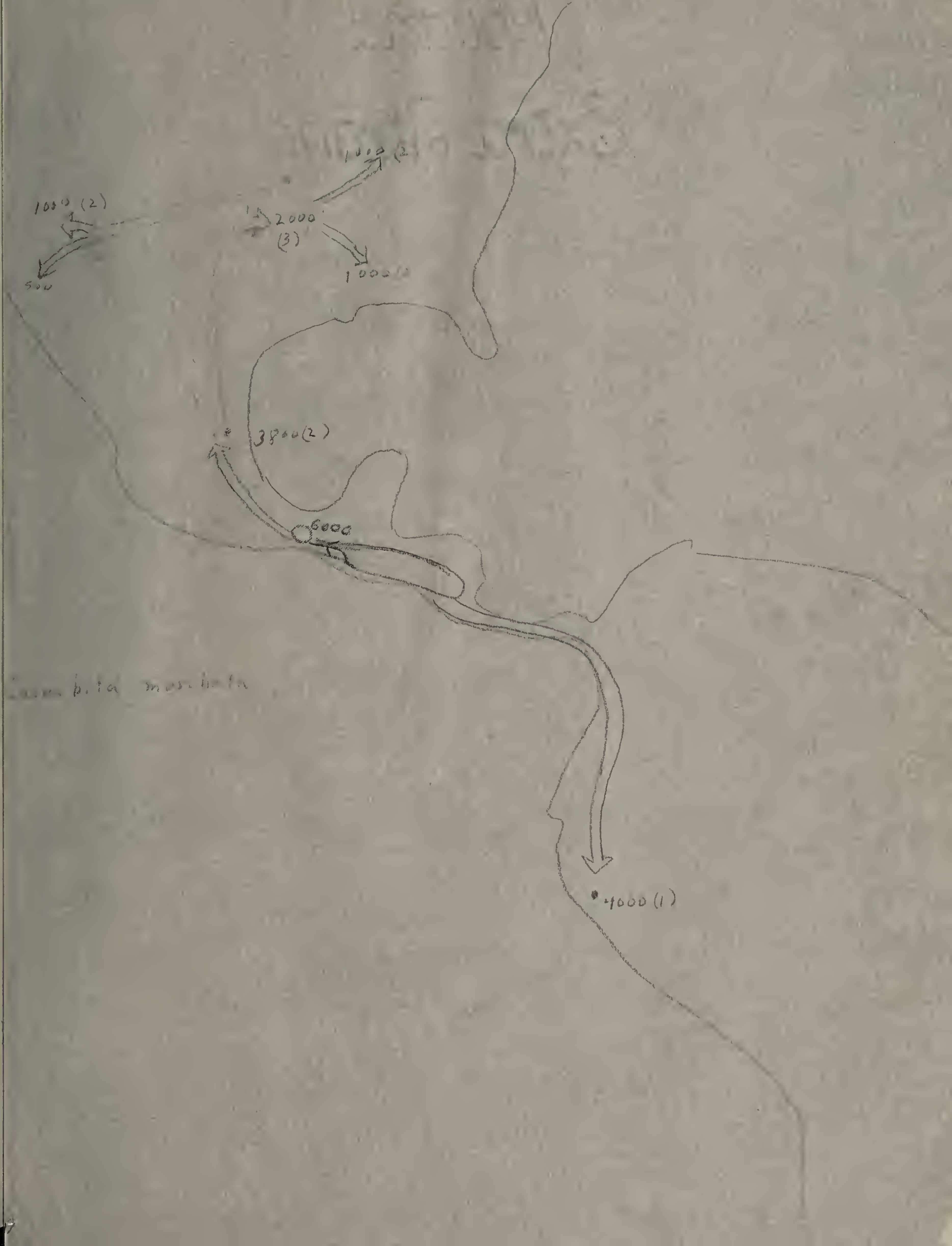
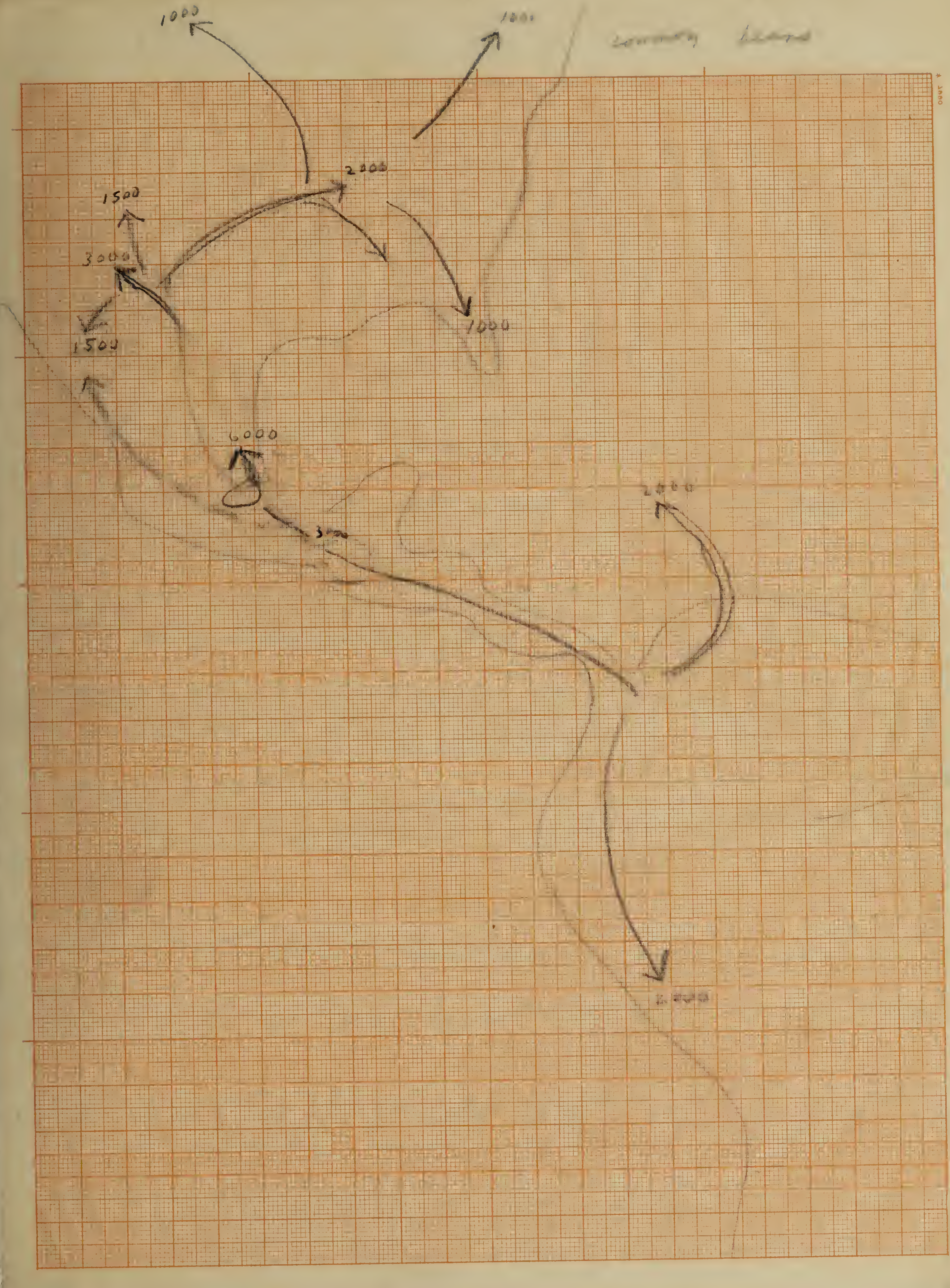


Cucurbita moschata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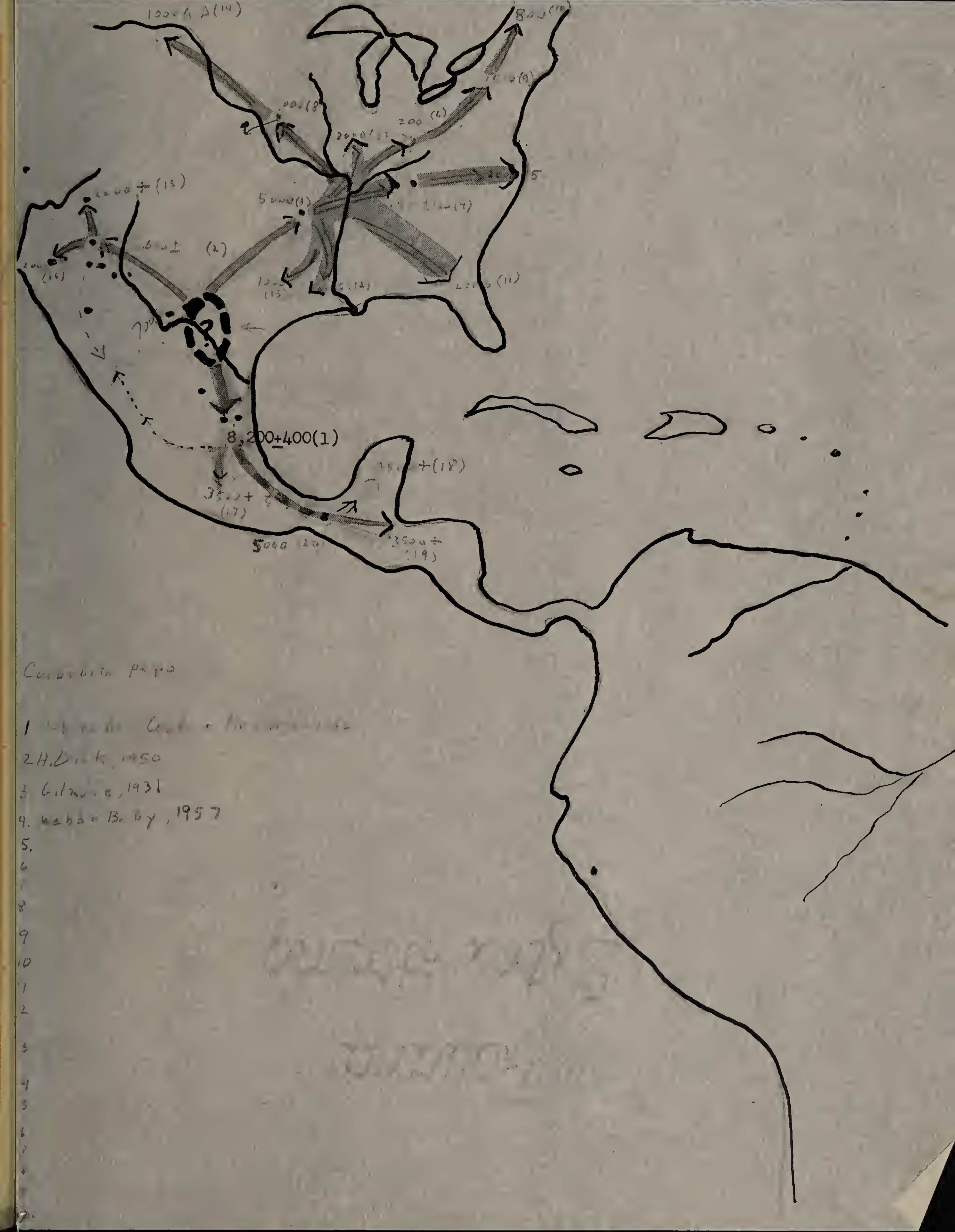

Cucurbita pepo

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2 H. Dick, 1950
3 Gilmore, 1931
4. [illegible], 1957
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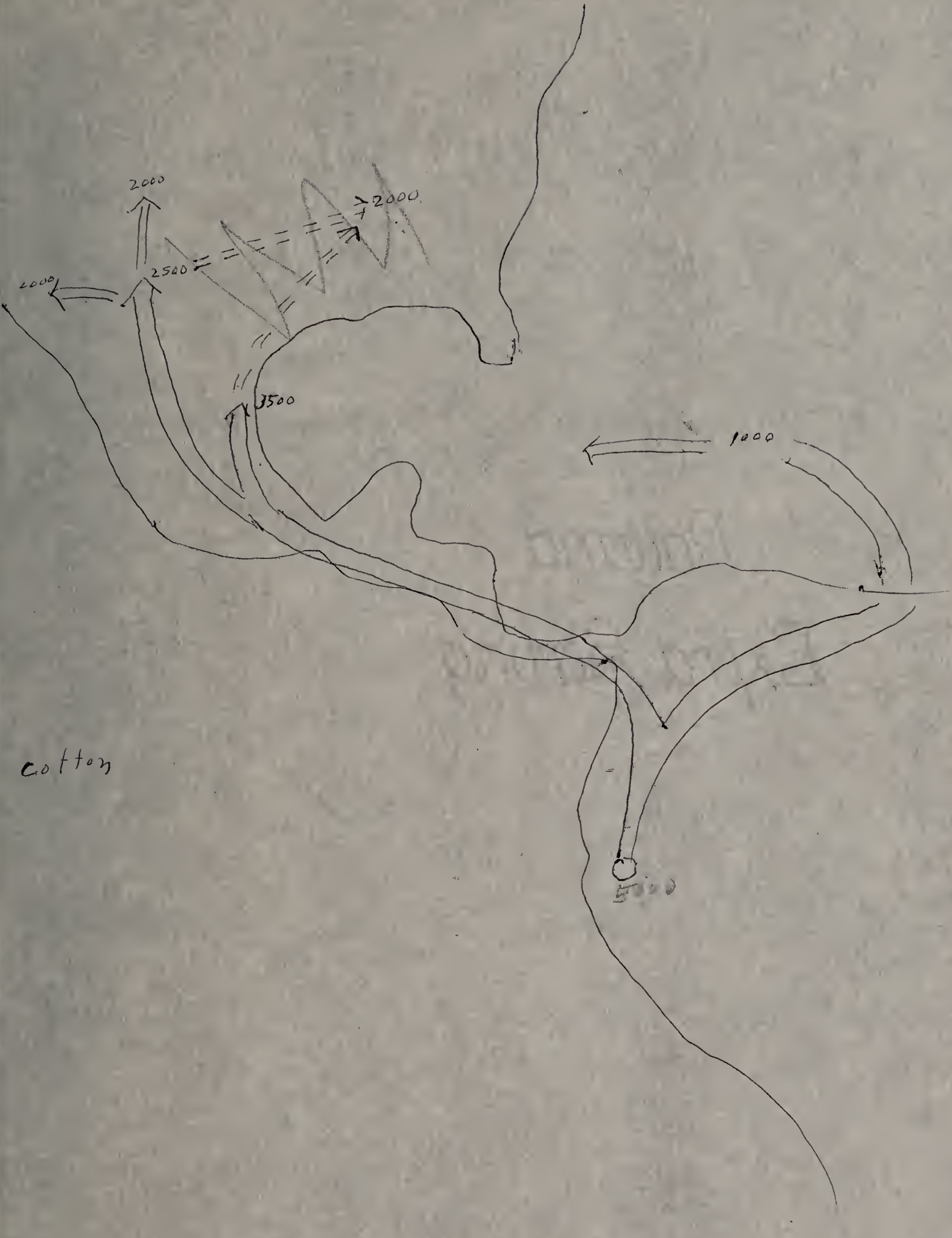
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cotton

different species

at perhaps 1,000 A.D., tobacco spread from Florida into the Caribbean Islands and perhaps from there (or Mexico) into South America. There is also one possible last prehistoric movement of tobacco at 1,500 A.D., from the Great Plains across the Rockies to the Northwest coast.

Now as a summary, let us take a look at the various places where agriculture seems to have developed. Three plants may have developed in Guatemala; two plants in Peru and two in Central America; one plant first occured in the eastern United States; ~~one plant first appeared in the southwest or southern plains~~; and one plant in northeast Mexico; and another in Northwest Mexico. One plant also may have spread from Africa to the Atlantic coast. Thus, I think, there is considerable evidence that as far as New World agriculture is concerned, there were multiple origins of domesticated plants and the various theories concerning hearths or centres of domestication are completely untenable. As far as when domestication occurred the idea that they occur at any single time period seems to be equally unwarranted. Talking in terms of millennia, two domesticated plants were utilized by 7,000 B.C., two more added by 6,000 B.C., one at 5,000 B.C. and another at 4,000 B.C., possibly ~~three~~ two about 3,000 B.C., one at 2,000 B.C., one at 1,000 B.C. and one at the time of Christ. Thus it would seem there is no specific climatic period or geographic area that may be definitely correlated with plant domestication in the New World. Perhaps when more evidence is available this process will be seen to be similar in the Old World.

We have now discussed at some length when and where various New World plants were domesticated. We have also said or speculated about how these plants might have diffused in the New World. The question now becomes: do we know how these plants became domesticated. Believe it or not, we actually do have some evidence. Our answers are a little

better than hypothesis, but at least we have some hints. These hints come in part from the refuse remains of plants that were found in the various Tamaulipas caves but most of it comes from the magnificent study ? done by Dr. Callan of the feces found at the various levels in the caves. Here he had an adequate sample from the Sierra Madre of more than 3,000 and so far about 180 from the earlier horizom have been studied. In his analysis he has been picking these apart and given us some vital hints as to how plants became domesticated. As yet we only have a fairly clear picture with three plants, that is pumpkins, beans and corn. Our best picture comes from the Callan study of the pumpkin remains in the feces. Archaeologically, only seeds (some of them burned) are found in the feces from the period of 6,000 to 1,500 B.C. There is some change in the size of seeds, with the seeds reaching their greatest size about 3,000 B.C. Abruptly at 1,500 B.C. there not only are squash seeds in the feces, but also parts of shell and parts of the meats of the plant. Still later, at about the time of Christ we begin to see a great deal of hybridization and many varieties of squash. Now let us reconstruct or attempt to reconstruct the process that has occurred with squash. In the earliest periods wild squash seeds were eaten like other seeds from various other plants. Probably, the actual squash meat itself on a very small squash was too sour or bitter to digest. The next step became the planting of these seeds so that in their calendar round of foodgathering they could return to the same place and get more squash and more squash seeds. The next step seems to have been from our archaeological evidence the selection of large seeds for replanting. This, of course, resulted in increase in seed size and probably actual squash size. Dr. Whittaker has informed me that there is a direct correlation between the size of the pumpkin and the amount of acidity. Thus it may have happened that by 1,500 B.C. the actual body was sufficiently greatly increased so that the meat was now palatable; thus there

was a shift from eating seeds to eating meat. By the time of Christ and probably with greater contacts with other areas, other varieties of squash were met and taken on by our people in Tamaulipas. This, of course, resulted in hybrids. Here again that better hybrids were further selected. Thus we have a picture of how our squashes were domesticated; and we also see that there is actual shift in the use of the squash and the pumpkin from seeds to using the whole plant.

Our picture with beans is less clear. However, as far as the refuse are concerned before 2,000 B.C. all our bean remains are of green beans, and and pod fragments are numerous. These pods were chewed and eaten green. There are no mature beans and there is no evidence that beans were soaked and then boiled. With the coming of pottery, the exact reverse is true. The bean skin fragments appear in the feces, show the beans to have been fully mature and we can guess that they have been boiled in the pots that had just recently come in. Thus again there is a shift from eating green beans to eating boiled beans.

Our picture with corn is even less clear. However, as Dr. Mangelsdorf has pointed out the chewed quids may be significant Also~~, there have now been found in Ocampo feces, husk, silk, cob and pollen but no kernels~~. This suggests that small pod-pop corns were chewed, leaf, husk, cob and all, and the juice sucked in and the remainder chewed and then spat out. This may have been the way that corn was first utilized, first in the wild state and then in the domesticated state. Again it would appear that selection of large grain for planting began at a relatively early date. Then as our corn cobs became too large and as accidental hybridization took place, and pods around the actual kernel disappeared, there seems to have been a shift from chewing green ears and from sucking the juice to actually eating the kernel alone. At a much later date, there is still another shift, and this is of letting the cobs

and kernels dry and then cutting off the kernel and grinding it on metates either for a soup or mixtamal for tortillas. Also, the finding of a leather bag filled with teocenti grains (difficult to eat but excellent for corn hybridization) suggest a latter period of conscious hybridization of corn.

If this is the sort of process by which plants become domesticated we might hazard a generalization, that is, if the potentially domesticated plant were initially treated like any other wild plant but due to accident, design and selection, these plants are transformed and then become treated in an entirely different way, this often being the way at their use at present and in the civilized prehistoric cultures in early Mexico and Peru. Our total picture of how plants were actually domesticated is from from clear, but further work, particularly on feces, I am sure, will give us a much better idea of this process.

Thus we end our factual data on domesticated plants from Tamaulipas. What are our conclusions?

1) That in the New World plant collectors domesticated at least twelve different species of plants at eight different places, from the eastern United States to as far south as Peru or Bolivia. These were domesticated at different preiods, from 10,000 years ago to 2,000 ago. In other words, there are multiple origins for New World agricultural plants at entirely different time periods.

2) That many domesticated plants (often with changed uses) slowly spread by various different routes throughout much of the New World before the use of pottery, and in some instances during early Ceramic times. Thus I would suspect that by 2,000 B.C. in Meso-America most of the domesticated plants that were used later were already known. This spread, of course, was slower in the peripherial areas, so that our twenty or so varieties were not known in Tamaulipas till about 300 A.D. However, in Mexico - except for tobacco and canavallia - the major ones were probably all known from before the time of the first villages.

3) That this gradual 6,000 years period of accretion of domesticated plants by people who were basically plant collector, resulted in their being tied to specific plots of ground, the resultant being the establishment of villages. Thus the greater and greater use of domesticated plants, which most people received by diffusion, meant they became more and more settled, and - of course, - that as they became more and more settled in single spots,villages arose.

4.) That with the increase in number of towns and further settlements, numerous plant hybrids occurred, In conclusion I cannot but wonder does this mean that there were full time agricultural specialists in plant breeding during the period of towns in Meso-America and the Andean areas.

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